Hypoglycemia

National Diabetes Information Clearinghouse

National Institute of Diabetes and Digestive and Kidney Diseases

NATIONAL INSTITUTES OF HEALTH

Hypoglycemia, also called low blood sugar, occurs when your blood glucose (blood sugar) level drops too low to provide enough energy for your body's activities. In adults or children older than 10 years, hypoglycemia is uncommon except as a side effect of diabetes treatment, but it can result from other medications or diseases, hormone or enzyme deficiencies, or tumors.

Glucose, a form of sugar, is an important fuel for your body. Carbohydrates are the main dietary sources of glucose. Rice, potatoes, bread, tortillas, cereal, milk, fruit, and sweets are all carbohydrate-rich foods.

After a meal, glucose molecules are absorbed into your bloodstream and carried to the cells, where they are used for energy. Insulin, a hormone produced by your pancreas, helps glucose enter cells. If you take in more glucose than your body needs at the time, your body stores the extra glucose in your liver and muscles in a form called glycogen. Your body can use the stored glucose whenever it is needed for energy between meals. Extra glucose can also be converted to fat and stored in fat cells.

When blood glucose begins to fall, glucagon, another hormone produced by the pancreas, signals the liver to break down glycogen and release glucose, causing blood glucose levels to rise toward a normal level. If you have diabetes, this glucagon response to hypoglycemia may be impaired, making it harder for your glucose levels to return to the normal range.

Symptoms

Symptoms of hypoglycemia include

- hunger
- nervousness and shakiness
- perspiration
- dizziness or light-headedness
- sleepiness
- confusion
- difficulty speaking
- feeling anxious or weak

Hypoglycemia can also happen while you are sleeping. You might

- cry out or have nightmares
- find that your pajamas or sheets are damp from perspiration
- feel tired, irritable, or confused when you wake up

U.S. Department of Health and Human Services

Hypoglycemia: A Side Effect of Diabetes Medications

Hypoglycemia can occur in people with diabetes who take certain medications to keep their blood glucose levels in control. Usually, hypoglycemia is mild and can easily be treated by eating or drinking something with carbohydrate. But left untreated, hypoglycemia can lead to loss of consciousness. Although hypoglycemia can happen suddenly, it can usually be treated quickly, bringing your blood glucose level back to normal.

Causes of Hypoglycemia

In people taking certain blood-glucose lowering medications, blood glucose can fall too low for a number of reasons:

- meals or snacks that are too small, delayed, or skipped
- excessive doses of insulin or some diabetes medications, including sulfonylureas and meglitinides (Alpha-glucosidase inhibitors, biguanides, and thiazolidinediones alone should not cause hypoglycemia but can when used with other diabetes medicines.)
- increased activity or exercise
- excessive drinking of alcohol

Prevention

Your diabetes treatment plan is designed to match your medication dosage and schedule to your usual meals and activities. If you take insulin but then skip a meal, the insulin will still lower your blood glucose, but it will not find the food it is designed to break down. This mismatch might result in hypoglycemia.

To help prevent hypoglycemia, you should keep in mind several things:

- **Your diabetes medications.** Some medications can cause hypoglycemia. Ask your health care provider if yours can. Also, always take medications and insulin in the recommended doses and at the recommended times.
- **Your meal plan.** Meet with a registered dietitian and agree on a meal plan that fits your preferences and lifestyle. Do your best to follow this meal plan most of the time. Eat regular meals, have enough food at each meal, and try not to skip meals or snacks.
- **Your daily activity.** Talk to your health care team about whether you should have a snack or adjust your medication before sports or exercise. If you know that you will be more active than usual or will be doing something that is not part of your normal routine—shoveling snow, for example—consider having a snack first.

What to Ask Your Doctor About Your Diabetes Medications

- ❑ Could my diabetes medication cause hypoglycemia?
- ❑ When should I take my diabetes medication?
- ❑ How much should I take?
- ❑ Should I keep taking my diabetes medication if I am sick?
- ❑ Should I adjust my medication before exercise?

- **Alcoholic beverages.** Drinking, especially on an empty stomach, can cause hypoglycemia, even a day or two later. If you drink an alcoholic beverage, always have a snack or meal at the same time.
- **Your diabetes management plan.** Intensive diabetes management—keeping your blood glucose as close to the normal range as possible to prevent long-term complications—can increase the risk of hypoglycemia. If your goal is tight control, talk to your health care team about ways to prevent hypoglycemia and how best to treat it if it does occur.

Treatment

If you think your blood sugar is too low, use a blood glucose meter to check your level. If it is 70 mg/dL or below, have one of these "quick fix" foods right away to raise your blood glucose:

- 2 or 3 glucose tablets
- 1/2 cup (4 ounces) of any fruit juice
- 1/2 cup (4 ounces) of a regular **(not diet)** soft drink
- 1 cup (8 ounces) of milk
- 5 or 6 pieces of hard candy
- 1 or 2 teaspoons of sugar or honey

After 15 minutes, check your blood glucose again to make sure that it is no longer too low. If it is still too low, have another serving. Repeat these steps until your blood glucose is at least 70. Then, if it will be an hour or more before your next meal, have a snack.

If you take insulin or a diabetes medication that can cause hypoglycemia, always carry one of the quick-fix foods with you. Wearing a medical identification bracelet or necklace is also a good idea.

Normal and target blood glucose ranges (mg/dL)

Normal blood glucose levels in people who do not have diabetes	
Upon waking (fasting)	70 to 110
After meals	70 to 140
Target blood glucose levels in people who have diabetes	
Before meals	90 to 130
1 to 2 hours after the start of a meal	less than 180
Hypoglycemia (low blood glucose)	70 or below

Exercise can also cause hypoglycemia. Check your blood glucose before you exercise.

Severe hypoglycemia can cause you to lose consciousness. In these extreme cases when you lose consciousness and cannot eat, glucagon can be injected to quickly raise your blood glucose level. Ask your health care provider if having a glucagon kit at home and at work is appropriate for you. This is particularly important if you have type 1 diabetes. Your family, friends, and co-workers will need to be taught how to give you a glucagon injection in an emergency.

Prevention of hypoglycemia while you are driving a vehicle is especially important. Checking blood glucose frequently and snacking as needed to keep your blood glucose above 70 mg/dL will help prevent accidents.

Hypoglycemia and Diabetes: Doing Your Part

Signs and symptoms of hypoglycemia can vary from person to person. Get to know your own signs and describe them to your friends and family so they will be able to help you. If your child has diabetes, tell school staff about hypoglycemia and how to treat it.

If you experience hypoglycemia several times a week, call your health care provider. You may need a change in your treatment plan: less medication or a different medication, a new schedule for your insulin shots or medication, a different meal plan, or a new exercise plan.

Hypoglycemia in People Who Do Not Have Diabetes

Two types of hypoglycemia can occur in people who do not have diabetes: reactive (postprandial, or after meals) and fasting (postabsorptive). Reactive hypoglycemia is not usually related to any underlying disease; fasting hypoglycemia often is.

Symptoms

Symptoms of both types resemble the symptoms that people with diabetes and hypoglycemia experience: hunger, nervousness, perspiration, shakiness, dizziness, light-headedness, sleepiness, confusion, difficulty speaking, and feeling anxious or weak.

If you are diagnosed with hypoglycemia, your doctor will try to find the cause by using laboratory tests to measure blood glucose, insulin, and other chemicals that play a part in the body's use of energy.

Reactive Hypoglycemia

In reactive hypoglycemia, symptoms appear within 4 hours after you eat a meal.

Diagnosis

To diagnose reactive hypoglycemia, your doctor may

- ask you about signs and symptoms
- test your blood glucose **while you are having symptoms** (The doctor will take a blood sample from your arm and send it to a laboratory for analysis. A personal blood glucose monitor **cannot** be used to diagnose reactive hypoglycemia.)
- check to see whether your symptoms ease after your blood glucose returns to 70 or above (after eating or drinking)

A blood glucose level of less than 70 mg/dL at the time of symptoms and relief after eating will confirm the diagnosis.

The oral glucose tolerance test is no longer used to diagnose hypoglycemia; experts now know that the test can actually trigger hypoglycemic symptoms.

Causes and Treatment

The causes of most cases of reactive hypoglycemia are still open to debate. Some researchers suggest that certain people may be more sensitive to the body's normal release of the hormone epinephrine, which causes many of the symptoms of hypoglycemia. Others believe that deficiencies in glucagon secretion might lead to hypoglycemia.

A few causes of reactive hypoglycemia are certain, but they are uncommon. Gastric (stomach) surgery, for instance, can cause hypoglycemia because of the rapid passage of food into the small intestine. Also, rare

enzyme deficiencies diagnosed early in life, such as hereditary fructose intolerance, may cause reactive hypoglycemia.

To relieve reactive hypoglycemia, some health professionals recommend taking the following steps:

- eat small meals and snacks about every 3 hours
- exercise regularly
- eat a variety of foods, including meat, poultry, fish, or nonmeat sources of protein; starchy foods such as whole-grain bread, rice, and potatoes; fruits; vegetables; and dairy products
- choose high-fiber foods
- avoid or limit foods high in sugar, especially on an empty stomach

Your doctor can refer you to a registered dietitian for personalized meal planning advice. Although some health professionals recommend a diet high in protein and low in carbohydrates, studies have not proven the effectiveness of this kind of diet for reactive hypoglycemia.

Fasting Hypoglycemia

Diagnosis

Fasting hypoglycemia is diagnosed from a blood sample that shows a blood glucose level of less than 50 mg/dL after an overnight fast, between meals, or after exercise.

Causes and Treatment

Causes include certain medications, alcohol, critical illnesses, hormonal deficiencies, some kinds of tumors, and certain conditions occurring in infancy and childhood.

Medications

Medications, including some used to treat diabetes, are the most common cause of hypoglycemia. Other medications that can cause hypoglycemia include

- salicylates, including aspirin, when taken in large doses
- sulfa medicines, which are used to treat infections
- pentamidine, which treats a very serious kind of pneumonia
- quinine, which is used to treat malaria

If using any of these medications causes your blood glucose to drop, your doctor may advise you to stop using the drug or change the dosage.

Alcohol

Drinking, especially binge drinking, can cause hypoglycemia because your body's breakdown of alcohol interferes with your liver's efforts to raise blood glucose. Hypoglycemia caused by excessive drinking can be very serious and even fatal.

Critical Illnesses

Some illnesses that affect the liver, heart, or kidneys can cause hypoglycemia. Sepsis (overwhelming infection) and starvation are other causes of hypoglycemia. In these cases, treatment targets the underlying cause.

Hormonal Deficiencies

Hormonal deficiencies may cause hypoglycemia in very young children, but usually not in adults. Shortages of cortisol, growth hormone, glucagon, or epinephrine can lead to fasting hypoglycemia. Laboratory tests for hormone levels will determine a diagnosis and treatment. Hormone replacement therapy may be advised.

Tumors
Insulinomas, insulin-producing tumors, can cause hypoglycemia by raising your insulin levels too high in relation to your blood glucose level. These tumors are very rare and do not normally spread to other parts of the body. Laboratory tests can pinpoint the exact cause. Treatment involves both short-term steps to correct the hypoglycemia and medical or surgical measures to remove the tumor.

Conditions Occurring in Infancy and Childhood
Children rarely develop hypoglycemia. If they do, causes may include

- Brief intolerance to fasting, often in conjunction with an illness that disturbs regular eating patterns. Children usually outgrow this tendency by age 10.
- Hyperinsulinism, which is the excessive production of insulin. This condition can result in transient neonatal hypoglycemia, which is common in infants of mothers with diabetes. Persistent hyperinsulinism in infants or children is a complex disorder that requires prompt evaluation and treatment by a specialist.
- Enzyme deficiencies that affect carbohydrate metabolism. These deficiencies can interfere with the body's ability to process natural sugars, such as fructose and galactose, glycogen, or other metabolites.
- Hormonal deficiencies such as lack of pituitary or adrenal hormones.

Hope Through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) was established by Congress in 1950 as one of the National Institutes of Health under the U.S. Department of Health and Human Services. The NIDDK conducts and supports research in diabetes, glucose metabolism, and related conditions. Researchers supported by NIDDK are investigating topics such as

- What are the causes of hypoglycemia?
- Can islet cell transplantation eliminate hypoglycemia?
- Can laparoscopy (a surgical procedure) be used to find and remove insulinomas (insulin-producing tumors)?
- Do new frequent-glucose-monitoring devices help prevent hypoglycemia?
- Why do repeated episodes of hypoglycemia lead to loss of awareness of hypoglycemia symptoms?

A complete listing of clinical research studies can be found at *http://ClinicalTrials.gov* on the Internet.

Points to Remember

Diabetes-Related Hypoglycemia

- If you think your blood glucose is low, check it and treat the problem right away.
- To treat hypoglycemia, have a serving of a quick-fix food, wait 15 minutes, and check your blood glucose. Repeat the treatment until your blood glucose is above 70.
- Keep quick-fix foods in the car, at work—anywhere you spend time.
- Be careful when you are driving. Check your blood glucose frequently and snack as needed to keep your level above 70 mg/dL.

Hypoglycemia Unrelated to Diabetes

- In reactive hypoglycemia, symptoms occur within 4 hours of eating. People with this condition are usually advised to follow a healthy eating plan recommended by a registered dietitian.
- Fasting hypoglycemia can be caused by certain medications, critical illnesses, hereditary enzyme or hormonal deficiencies, and some kinds of tumors. Treatment targets the underlying problem.

For More Information

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The National Diabetes Information Clearinghouse (NDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health under the U.S. Department of Health and Human Services. Established in 1978, the Clearinghouse provides information about diabetes to people with diabetes and to their families, health care professionals, and the public. The NDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about diabetes.

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts. This fact sheet was reviewed by Catherine L. Martin, M.S., R.N., C.D.E., University of Michigan Health System, Ann Arbor, MI; and Neil H. White, M.D., C.D.E., Department of Pediatrics, Washington University School of Medicine and St. Louis Children's Hospital, St. Louis, MO.

This fact sheet is also available at *www.diabetes.niddk.nih.gov.*

U.S. DEPARTMENT OF HEALTH
AND HUMAN SERVICES
National Institutes of Health

NIH Publication No. 03–3926
March 2003